DEPAS Handy

DIESEL ENGINE PERFORMANCE ANALYSING SYSTEM

DEPAS LABORATORY

diesel engines computer monitoring since 1992

- Standard version with pressure sensor and vibro sensor
- Basic working process parameters plus injection phases plus valves timing
- Improved PLS-algorithm of internal TDC determination
- Powerful software

DEPAS monitoring system

is designed and manufactured for using on marine diesel engines (main and auxiliary).
Also DEPAS can be used on other mobile and stationary power stations.

Main applications:

- main marine diesels
- auxiliary marine diesels
- railway engines
- power station engines

Brief Characteristics

Depas Handy unit measures the following parameters:

- Pmax - peak cylinder pressure (average, min, max)
- RPM - engine revolutions
- Automatic 2- or 4-stroke determination
- Spectrum-FFT data*

Depas software calculates the following:

- Pi - Cylinder indicated power
- MIP - mean indicated pressure
- TDC by using new improved PLS-algorithm
- Pressure and vibro diagrams
- the other parameters ... see page 2

Standard Set

- DEPAS Handy unit
- DEPAS software+manual
- PS-16 pressure sensor
- VS-20 vibro sensor
- Serial interface cable

* Optional

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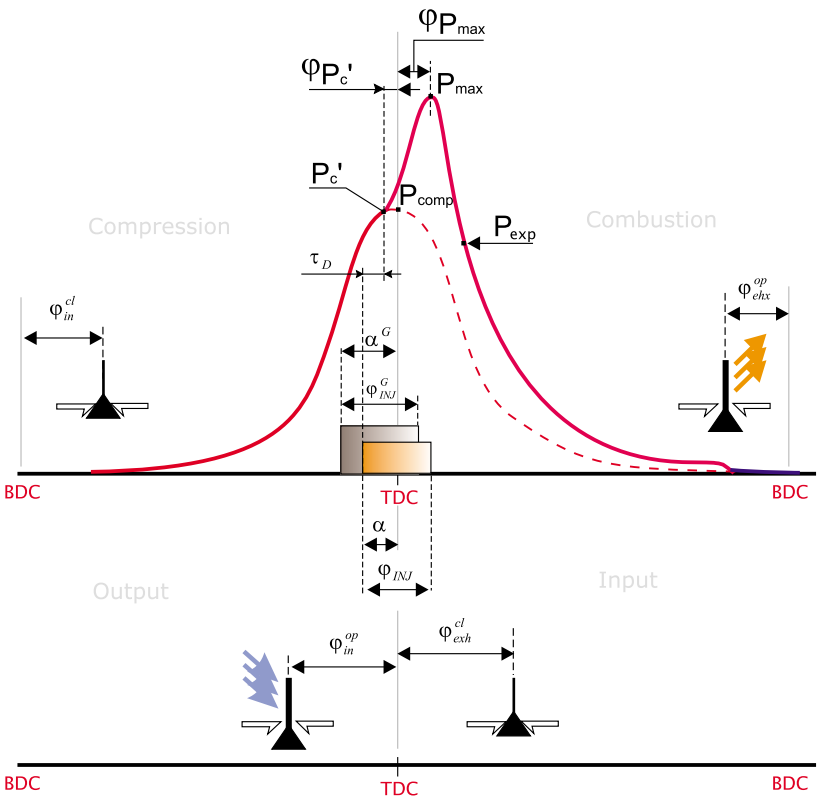
Diesel working process parameters monitored by DEPAS system



- ❑ Mean indicated pressure — MIP
- ❑ Cylinder indicated power — P_i
- ❑ Engine revolutions per minute — RPM
- ❑ Maximum combustion pressure (angle) — $p_{\max}, p_{\max}^{\min}, p_{\max}^{\max}(\varphi p_{\max})$
- ❑ Maximum compression pressure — p_{comp}
- ❑ Pressure on expansion curve (36° after TDC) — $P_{\exp}$
- ❑ Maximum speed of increasing pressure — $v_m = \frac{\Delta p}{\Delta \varphi}$
- ❑ Degree of increasing pressure — $\lambda = \frac{p_{\max}}{p_{comp}}$
- ❑ Combustion start pressure (angle) — $p_c^{'}(\varphi P_c^{'})$

- ❑ Real & geometrical angles of injection — $\alpha, \alpha^{G}, \varphi_{INJ}, \varphi_{INJ}^{G}$
- ❑ Period & angle of fuel ignition delay — $\tau_D, \varphi\tau_D$
- ❑ Valves timing — $\varphi_{in}^{op}, \varphi_{in}^{cls}, \varphi_{exh}^{cls}, \varphi_{exh}^{op}$
- ❑ Analysis of injectors & valves technical condition

- ❑ Pressure of any diagram point — p_x
- ❑ Spectrum-FFT data (optional)

DEPAS hardware

DEPAS Handy unit

Made by DEPAS lab.

Auto 2-4-stroke determination

contrast display
input/button LED
one button operation
RS-232 interface

about 10h. Operation time
130 x 80 x 40 mm
Weight 0.5 kg
6VDC (4 x A1)

PS-16 Pressure sensor

Made by DEPAS lab.

Range: 0-160 bar
Accuracy: <= 1.5%
Temp.: Max 350°C
Calibration interval: 3 years
Weight: 1 kg
...
For indicator cock on engine, W27x1/10

VS-20 Vibro sensor

Made by DEPAS lab.

Range:0.1 ÷ 18 kHz
Passband: 1.0 KHz
Temp.: Max 90°C
...
magnetic basis

DEPAS software

- P(φ) diagrams
- P(V) diagrams
- Derivative diagrams
- Vibration analysis of fuel injection and valves timing
- Balance diagrams
- Bar diagrams
- Engine total state table

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- Improved PLS-algorithm of internal TDC determination

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- Single cylinder report
- General report

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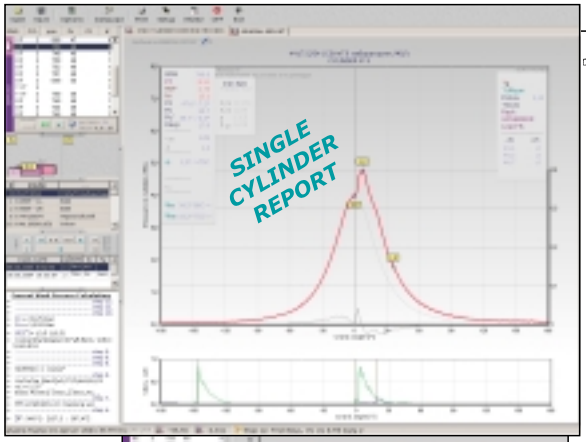
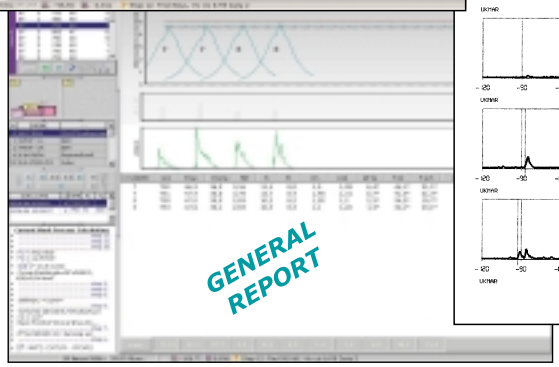
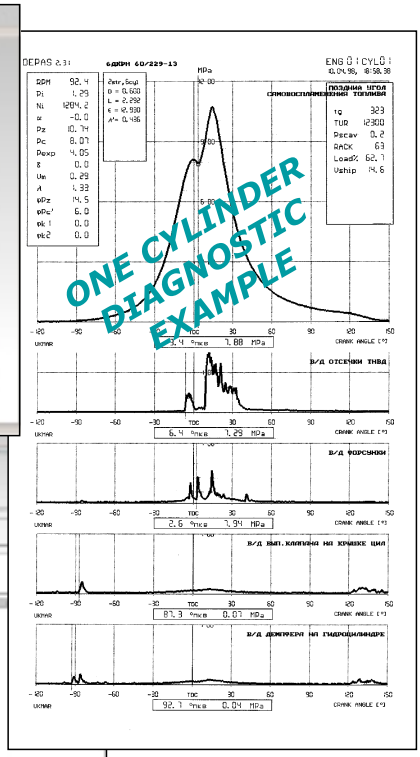
- Win 98/ME/2000/XP

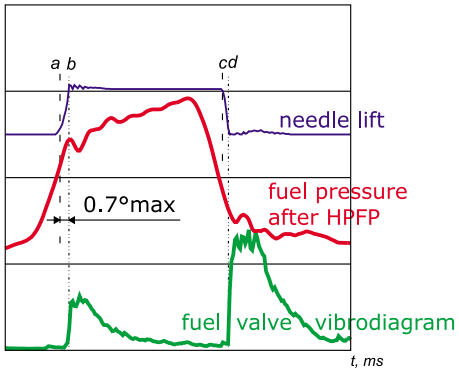


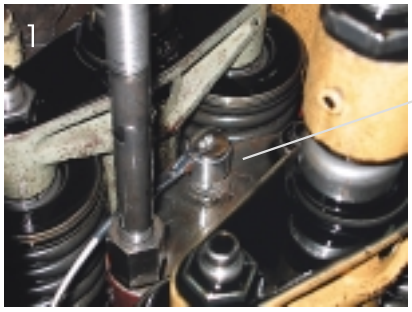




DEMO CD

DEPAS diagnostic example

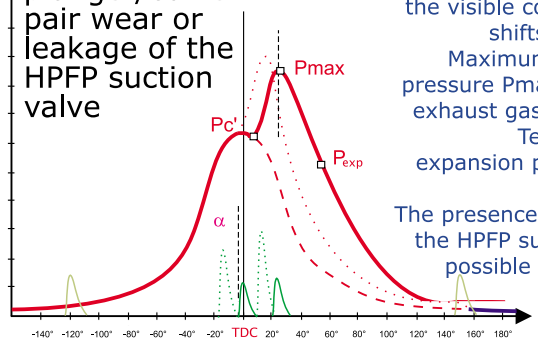




1. Vibro sensor VS-20 on the top of fuel valve (monitoring of injection vibrodiagram,determination of real fuel injection phases and valves timing)
2. Vibro sensor VS-20 on HPFP (monitoring of fuel feed vibrodiagram, determination of geometric fuel feed phases)
3. Pressure sensor PS-16 on indicator cock

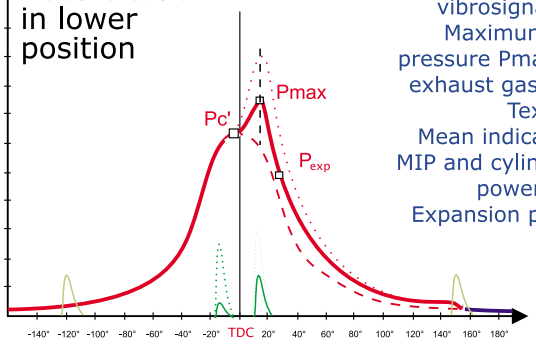
Some typical cases from our diagnostic library

HPFP plunger/barrel pair wear or leakage of the HPFP suction valve



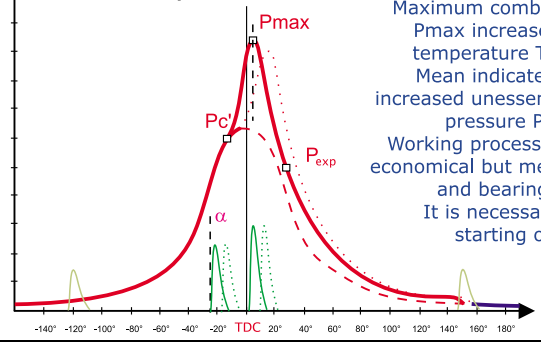
Injection vibrodiagram shifts to the right. Beginning of the visible combustion Pc' shifts to the right. Maximum combustion pressure Pmax decreases, exhaust gas temperature Texh increases, expansion pressure Pexp increases. The presence of leakage in the HPFP suction valve is possible for MAN B&W engines.

Injector's needle stuck in lower position



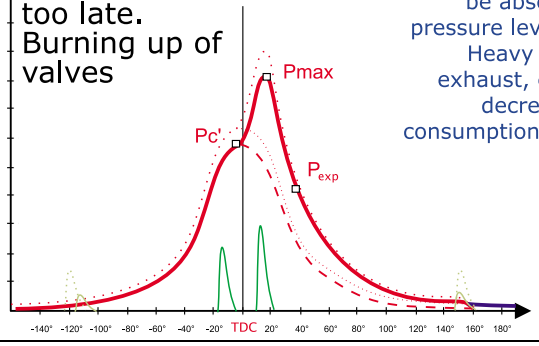
Injection vibrodiagram form is changed. Absence of vibrosignal is possible. Maximum combustion pressure Pmax decreases, exhaust gas temperature Texh decreases. Mean indicated pressure MIP and cylinder indicated power Pi decrease. Expansion pressure Pexp decreases.

Fuel injection is too early



Injection vibrodiagram shifts to the left. Beginning of the visible combustion Pc' shifts to the left. Maximum combustion pressure Pmax increases, exhaust gas temperature Texh decreases. Mean indicated pressure MIP increased unessential. Expansion pressure Pexp decreased. Working process becomes more economical but mechanical stress and bearing load increase. It is necessary to retard the starting of fuel injection.

Closing of inlet valve is too late. Burning up of valves



Vibration diagram of inlet valve closing shifts or may be absent. Common pressure level decreases. Heavy smoke at the exhaust, engine power decreases and fuel consumption is increased.

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Some reasons of choosing DEPAS Handy

'Nothing can replace accurate measurement of cylinder pressure'
Franz Pischinger Prof.Dr.techn FEV Motorentechnik
www.kistler.com

Use of DEPAS Handy enables to receive the following advantages in diesel engines operation:

- to save fuel, due to precise adjustment of fuel injection equipment and valves timing mechanism;
- to increase operational period between repairs and to reduce expenses for diesel engines service, due to calculating and balancing power of cylinders;
- to increase safety of ship diesel engines operation substantially, due to monitoring work process;
- to save money due to all above reasons.

DEPAS Handy features

- TDC definition and data synchronization by our software (unique high-math phaseless synchronization algorithm (PLS-) is used. *PLS-algorithm was thoroughly tested in previous generation systems DEPAS 2.34sp on different types (slow, middle, high speed) of engines; since that time the PLS-algorithm was substantially improved. Thanks to it* ***any connection to crankshaft is unnecessary.*** *Accurate TDC definition leads to precise calculation of mean indicated pressure MIP and indicated power Pi.*
- Valves timing, fuel timing and technical condition of separate units of the engine are determined with the help of contact vibrosensor VS-20. *The most important advantage and the unique feature of the system is that definition of these parameters occurs* ***without fitting any valves into high pressure fuel system and without hard connection to parts of gas distribution mechanism.***
  DEPAS laboratory was the first, who in 1992 employed vibrosensor in the diesel engine working process monitoring. Analyzing fuel injection equipment and valve timing mechanism vibrodiagrams together with working process indicator diagram significantly broadened the spectrum of monitored parameters. The engine cylinder technical condition diagnosis became possible not only by gas pressure (as it performed up to now in most other computer systems) but also by key data of fuel injection and valves timing.

- Vibro sensor is included in standard version. *The vibrosensor has a magnetic basis; it is convenient during diesel engine operation as no tools for its fastening are necessary.*
- Multi-engine collection capability
- Robust and reliable design
- One-button simple operation
- Total weight under 2 kg.
- Battery capacity - about 10 h. during operation

DEPAS laboratory ("Internal Combustion Engine Monitoring Laboratory") was created on the basis of Ship Engineering faculty of the Odessa National Maritime University (Order # 31_org from 17.04.2003).

Medal and Diploma on the "7th International Shipping, Shipbuilding, Offshore Energy & Ports Exhibition" NEVA-2003

DEPAS Team:
Left to right
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Alexandr A. Turchanov - *chief engineer, the technical adviser*
Victor P. Gubanov - *engineer*

Experimental Plants for testing high pressure fuel equipment of low-speed engines MAN B&W

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